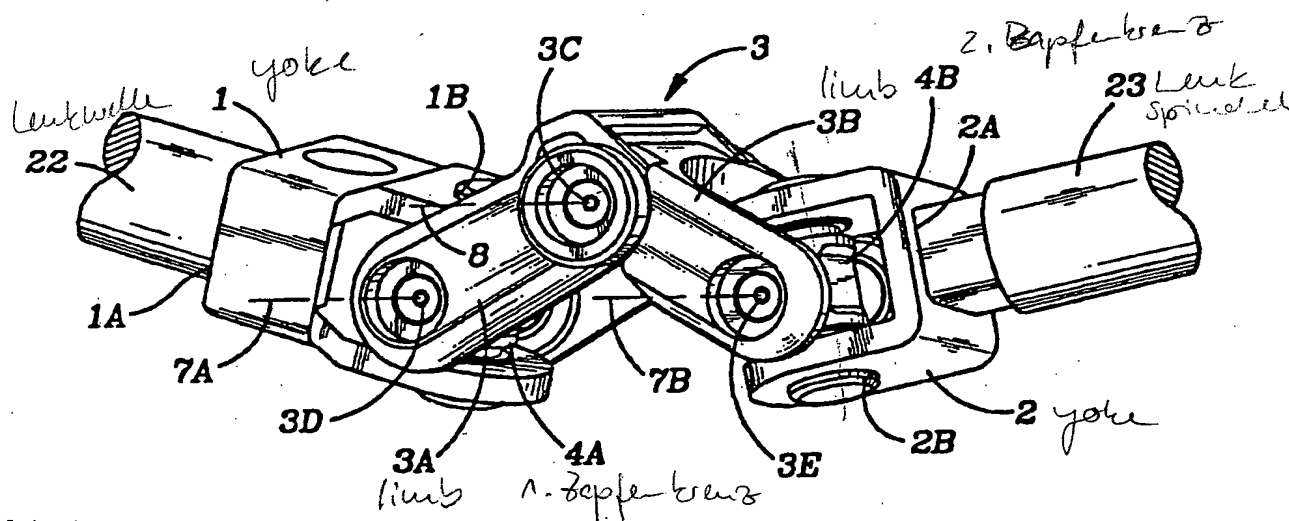


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : B62D 1/19, F16D 3/26	A1	(11) International Publication Number: WO 95/09757 (43) International Publication Date: 13 April 1995 (13.04.95)
(21) International Application Number: PCT/GB94/02136 (22) International Filing Date: 30 September 1994 (30.09.94) (30) Priority Data: 9320388.3 4 October 1993 (04.10.93) GB (71) Applicant: THE TORRINGTON COMPANY LIMITED [GB/GB]; Torrington Avenue, Coventry, Warwickshire CV4 9AE (GB). (72) Inventor: BARTON, Laurence, George; 15 Pleasant Way, Leamington, Warwickshire CV32 5XA (GB). (74) Agents: FEAKINS, Graham, Allan et al.; Raworth, Moss & Cook, 36 Sydenham Road, Croydon, Surrey CR0 2EF (GB).	(81) Designated States: AU, BR, CA, CN, JP, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>	

(54) Title: SHAFT COUPLING



(57) Abstract

A shaft coupling, especially for coupling upper and lower shafts (23, 22) of a vehicle steering column, comprises two yokes (1, 2) interconnected through respective cross members (4A, 4B) by a pivotable elbow member (3), having two limbs (3A, 3B) pivoted together. The outer end of each limb (3A, 3B) is coupled to a respective one of the cross members (4A, 4B) and the pivot axes (7A, 7B) of the elbow member (3) and the cross members (4A, 4B) mounted on the elbow member (3) are parallel to one another. The coupling is suitable for a steering column which is rake and/or reach adjustable and allows, upon impact in a crash situation collapse of the coupling so one limb contacts the other in order to transmit collapse effort through the coupling.

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SHAFT COUPLING

This invention relates to a shaft coupling and more particularly to shaft couplings for vehicle steering columns.

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Hitherto, with rotatable shaft couplings, e.g. for use in vehicle steering columns, there has been a problem of how to obtain satisfactory torque transmission through the coupling if the two ends of the shaft are mounted at an angle to one another.

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Furthermore, it is desirable for the coupling to allow collapse of the two ends of the shaft towards one another in the event of a vehicle crash.

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According to one aspect of the present invention, there is provided a shaft coupling comprising a first yoke, a first cross member pivotally connected to the first yoke, a second yoke, and a second cross member pivotally connected to the second yoke, characterised by a pivotable elbow member having two limbs pivotally connected, each cross member being pivotally connected to a respective one of the pivotable elbow member limbs.

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According to another aspect of the present invention, there is provided a shaft coupling comprising two universal joints characterised by a torque transmitting means for pivotally connecting the two universal joints and for transmitting torque from one universal joint to the other universal joint.

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The invention also extends to a vehicle steering column incorporating a shaft coupling essentially as just defined.

- 2 -

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:-

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Figure 1 shows an adjustable vehicle steering column incorporating a shaft coupling;

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Figure 2 is a perspective view of the shaft coupling shown in Figure 1 with the shaft coupling in an open position;

Figure 3 is a perspective view of the shaft coupling shown in Figure 1 with the shaft coupling in a collapsed position; and

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Figure 4 is a cross-sectional view taken on line 8-8 of Figure 2, showing the details of the central pivot pin and rubber bush.

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Referring to Figure 1, the adjustable steering column assembly 15 includes a steering rack 20, a lower, fixed mounting point 21, a lower shaft 23 of the steering column, a steering wheel 25 and an upper fixed mounting point 6 for the steering column assembly 15. The lower shaft 23 and steering rack 20 are connected by a shaft coupling 10 of the present invention. Steering column assembly 15 is reach and/or rake adjustable as shown by arrows A and B. An adjustment mechanism 27 is provided to reach adjust and/or rake adjust steering column assembly 15.

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The coupling includes two yokes, 1, 2, into which are to be mounted the ends of the shaft 23 and steering rack 20 pinion shaft. Figure 2 shows the coupling 10 in a normal operating, open position. The end of the steering rack 20 pinion shaft

- 3 -

is mounted in an aperture 1A of the yoke 1 and the end of the lower shaft 23 is mounted in an aperture 2A of the yoke 2. The yokes 1 and 2 are linked by cross members 4A, 4B, fitted in apertures 1B, 2B, respectively, in the limbs of the yokes, to an elbow member 3.

The elbow member 3 comprises two forked limbs 3A, 3B pivotably mounted together at 3C on a central pivot pin 5. Respective outer ends of the limbs 3A, 3B, i.e. the forked ends, are mounted on pivot points of the respective cross members 4A, 4B at 3D, 3E, on which the yokes 1 and 2 are also mounted.

It will be noted that the pivot axes 7A, 7B of the respective crosses 4A, 4B on the elbow member 3 are parallel to one another and are also parallel to the common pivot axis 8 of the two limbs 3A, 3B of the elbow member 3.

However, in the event of a vehicle crash, one limb, for example the limb 3A, can be pushed by the steering rack 20 pinion shaft to pivot so far that the limb 3A will close in on the edge walls of the fork of the limb 3B in the direction of the arrow C. In this condition, crash effort can be transmitted through the shaft coupling to a vehicle crash impact energy absorbing mechanism (not shown). The coupling 10 allows this collapse effort to work through the coupling 10, whatever the angle of mounting of the lower shaft 23 and the steering rack 20 pinion shaft of the vehicle steering column.

A vibration inhibiting isolator can be provided in the coupling 10 and one way of achieving this is by bonding rubber 9 on the central pivot pin 5 linking the two limbs 3A, 3B. Figure 4 shows details of the rubber isolation bush. This

- 4 -

rubber 9 will also assist in centralising the system during manufacture and provide a seal at 30 in Figure 4.

The two crosses 4A, 4B can incorporate built-in seals.

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During vehicle impact, the limbs 3A, 3B move or collapse into a closed position where the sides of limbs 3A, 3B contact one another (Figure 3). The present coupling 10 can accommodate 20mm to 25mm of movement from an open position to a closed position. The coupling 10 can also accommodate minor differences in the lengths of the steering rack 20 pinion shaft and the lower shaft 23 due to manufacturing tolerances. The shaft coupling 10 operates in an operating position wherein the limbs 3A, 3B are not co-axial, i.e. an angle less than 180 degrees.

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CLAIMS:

1. A shaft coupling (10) comprising a first yoke (1), a first cross member (4A) pivotally connected to the first yoke (1), a second yoke (2), and a second cross member (4B) pivotally connected to the second yoke (2), characterised by a pivotable elbow member (3) having two limbs (3A, 3B) pivotally connected, each cross member being pivotally connected to a respective one of the pivotable elbow member limbs (3A, 3B).

2. A shaft coupling according to claim 1, wherein the pivotable elbow member includes a central pivot pin (5) about which the two limbs (3A, 3B) pivot, torque being transmitted through the central pivot pin.

3. A shaft coupling according to claim 1 or 2, further comprising means (9) for inhibiting vibration transmission from one limb to the other limb.

4. A shaft coupling according to claims 2 and 3, wherein the means for inhibiting vibration transmission includes a rubber bush (9) about the central pivot pin.

5. A shaft coupling according to any one of the preceding claims, wherein each limb of the pivotable elbow member is forked so as to embrace and engage two ends of a said respective cross member.

6. A shaft coupling according to any one of the preceding claims, wherein the limbs contact each other when the pivotable elbow member is pivoted from an open position to a closed position.

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5 7. A shaft coupling according to any one of the preceding claims, wherein the limbs pivot from an operating position to a closed position, the angle between the limbs in the operating position being less than 180 degrees and the angle between the limbs in the closed position being less than the operating position angle.

10 8. A shaft coupling according to any one of the preceding claims, wherein the pivot axis (8) of the two limbs and the pivot axes (7A, 7B) of the cross members (4A, 4B) of the elbow member (3) are parallel to one another.

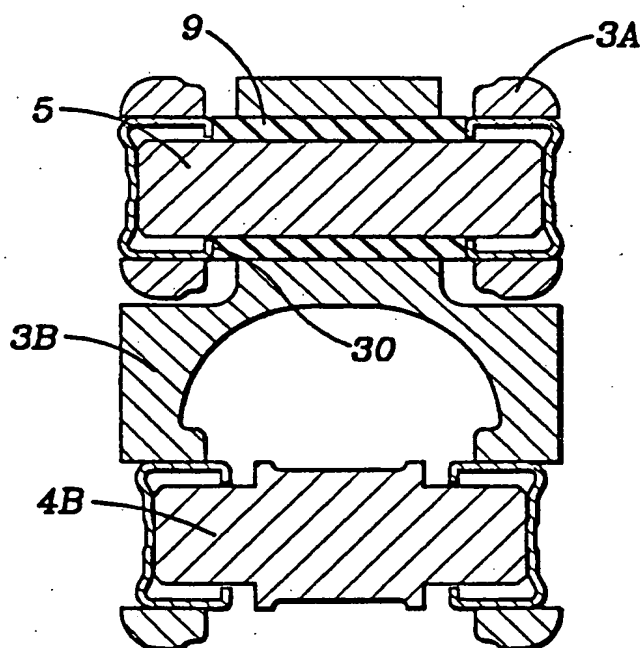
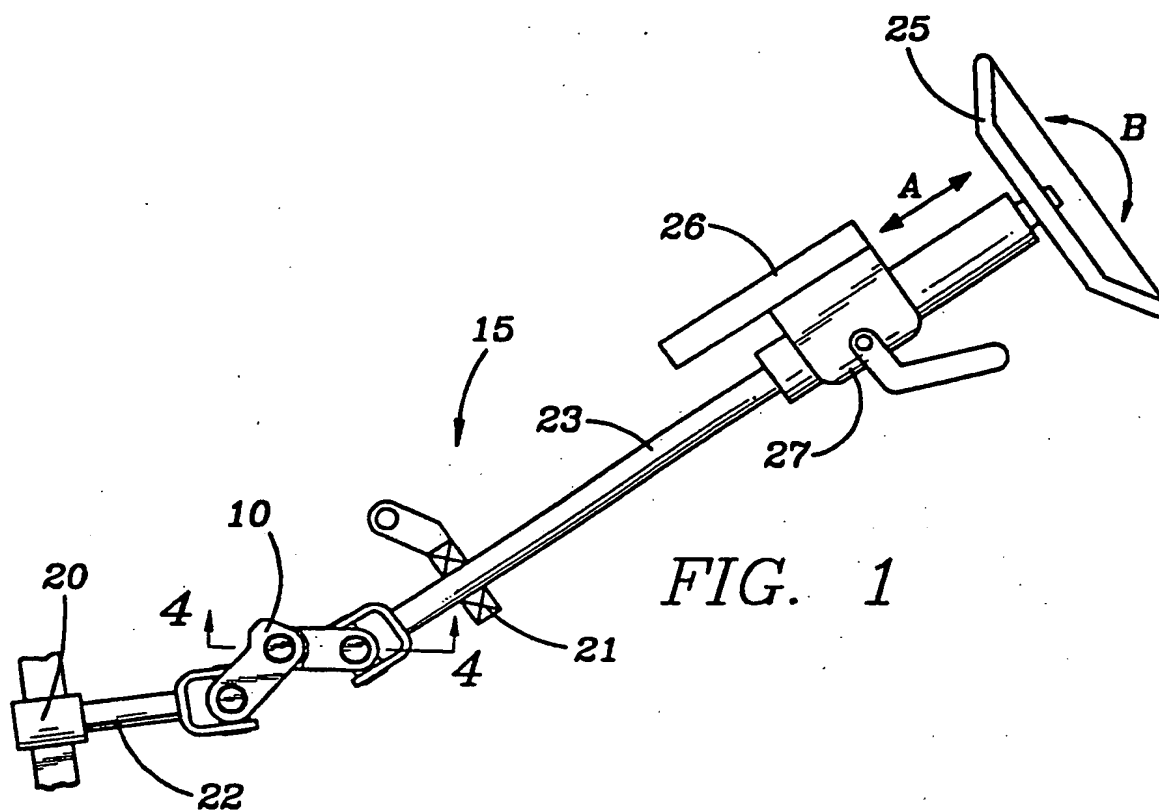
15 9. A shaft coupling (10) comprising two universal joints (1, 2) characterised by a torque transmitting means for pivotally connecting the two universal joints and for transmitting torque from one universal joint to the other universal joint.

20 10. A shaft coupling according to claim 9, wherein the torque transmitting means includes a central pivot pin (5) through which torque from one universal joint is transmitted to the other universal joint.

25 11. A vehicle steering column (15) incorporating a shaft coupling (10) according to any one of the preceding claims and comprising an upper shaft (20) and a lower shaft (23), the shaft coupling being coupled to the upper shaft and the lower shaft.

30 12. A vehicle steering column according to claim 11 as appendant to any one of claims 1 to 8, wherein the upper shaft and the lower shaft is coupled to a respective one of said yokes (1, 2).

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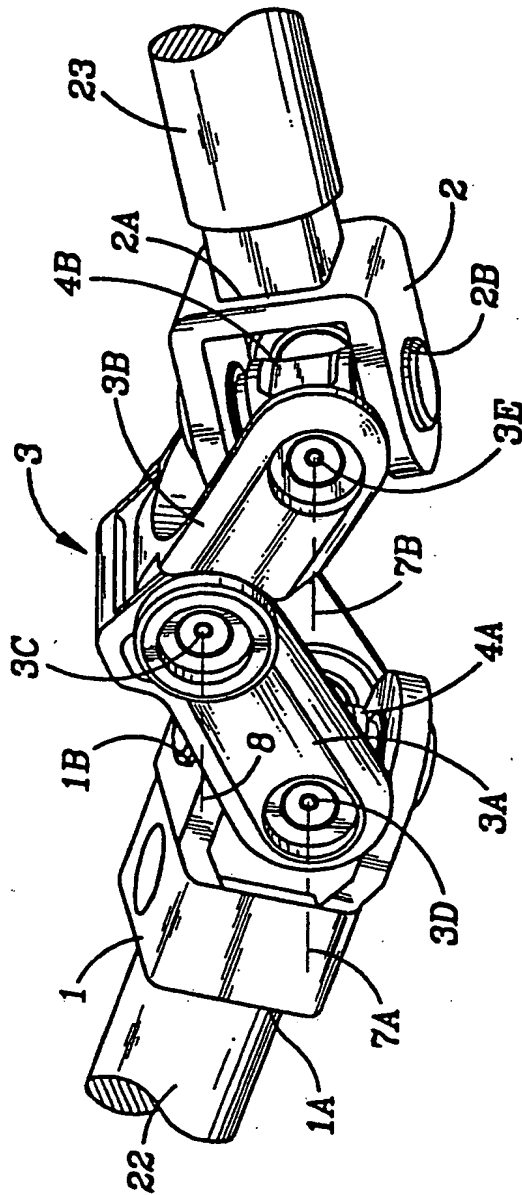


FIG. 2

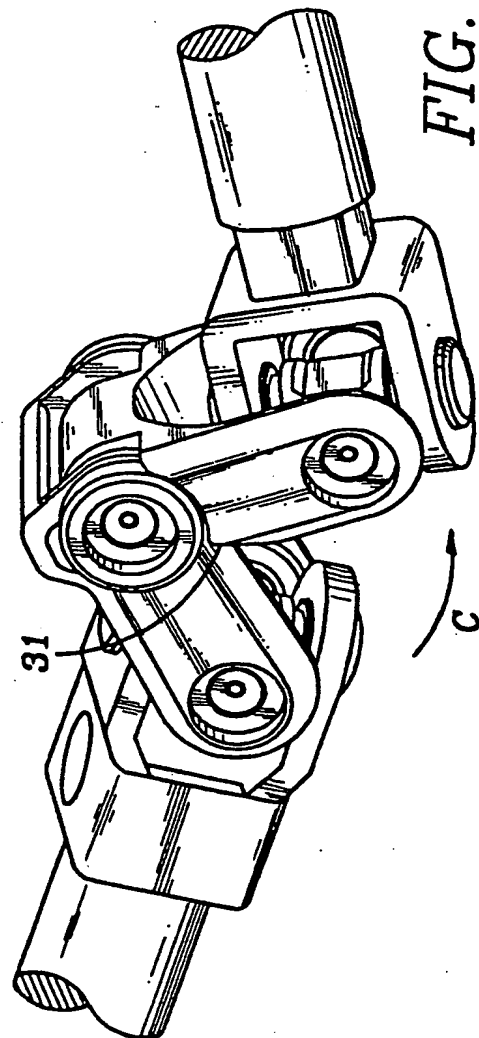


FIG. 3

INTERNATIONAL SEARCH REPORT

Intern. Application No

PCT/GB 94/02136

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 B62D1/19 F16D3/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B62D F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,C,379 788 (FRIED. KRUPP AKT.-GES.) 30 August 1923 see left column, line 26 - right column, line 56; figures	1,2,6, 8-10
Y		3,4
A		7
X	DE,A,37 23 034 (VOLKSWAGEN AG) 11 February 1988 see column 2, line 20 - line 55; figures 1,2	9-12
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Date of the actual completion of the international search

5 December 1994

Date of mailing of the international search report

16. 12. 94

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KULOZIK, E

INTERNATIONAL SEARCH REPORT

Intern. Application No.

PCT 94/02136

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>ATZ AUTOMOBILTECHNISCHE ZEITSCHRIFT, vol.93, no.7/8, July 1991, STUTTGART DE pages 416 - 425 KARL PEITSMEIER, HELMUT PATZELT, ARNO RÖHRINGER 'Die Lenkanlage der neuen Mercedes-Benz S-Klasse' see page 418, left column, paragraph 3 see page 418, right column, paragraph 2 see page 418, right column, last paragraph see page 418; figure 3</p>	9
Y	<p>DE,A,34 42 113 (DAIMLER-BENZ AG) 20 March 1986 see page 4, line 13 - line 19 see page 5, line 8 - line 33 see figures</p>	3,4

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-C-379788		NONE	
DE-A-3723034	11-02-88	NONE	
DE-A-3442113	20-03-86	NONE	